

Indian scientific output as seen through *Indian Science Abstracts*

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Analysis of 18,224 papers published by 3439 institutions in 445 Indian science journals and abstracted by *Indian Science Abstracts* (ISA) during 2006 indicates that major publication output came from academic institutions followed by state agriculture universities and medical colleges. Among the state agriculture universities, Punjab Agriculture University ranked first followed by CCS Haryana Agriculture University. The highest number of papers was published in the disciplines of agriculture, forestry, animal husbandry and fisheries followed by medical and veterinary sciences. The Indian publication output in 2006 has increased considerably as compared to a similar 1984 study.

Introduction

Since independence, India has developed a large infrastructure for science and technology with the setting up of several universities, national laboratories, and autonomous research institutions. Currently there is a lot of interest in the bibliometric assessment of the Indian science. Several bibliometric studies dealing with the assessment of Indian science using different international databases such as Science Citation Index (SCI)^{1,4}, and SCOPUS^{5,6} have been published in the literature. However, only two studies have appeared in literature to assess the Indian scientific output using *Indian Science Abstracts* (ISA) database. The first study to assess the Indian scientific output using ISA was made by Rangarao⁷ who analysed the papers abstracted by ISA for the year 1967. Later, Garg, Dutt and Gupta⁸ undertook a study, and analysed the papers abstracted by ISA for the year 1984. It is a common knowledge that the coverage of Indian science journals in SCI or SCOPUS is quite less as compared to journals indexed by ISA. Thus, SCI or SCOPUS does not reflect a complete picture of Indian scientific output. In view of this, it becomes imperative to examine the Indian scientific output using a more comprehensive database such as the ISA.

Indian Science Abstract (ISA), a semi-monthly abstracting periodical, began publication in January 1965 by the erstwhile Indian National Scientific Documentation Centre (INSDOC), now National Institute of Science Communication and Information Resources (NISCAIR). ISA comprehensively abstracts

the Indian S&T literature published in Indian S&T journals and is a leading abstracting service published from India. It is a multi-disciplinary database of science and technology and claims to scan about 800 journals. Abstracts in ISA are broadly classified according to Universal Decimal Classification (UDC) Scheme and arranged under UDC number (along with subject-headings). The abstracts are grouped under 26 broad classes.

Methodology

Data pertaining to the year 2006 was collected from the 2006, 2007 and 2008 web edition of *Indian Science Abstracts*. This was required as many Indian journals are published behind schedule and collecting the data from 2006 ISA edition only would result in exclusion of data pertaining to 2006 that have appeared in 2007 and 2008. The data so obtained from 2006, 2007 and 2008 issues were converted into a Fox-Pro database. ISA also scans records relating to patents, theses, and standards etc., which were excluded. Further, records not concerned with science and technology, such as management, information science etc., were also excluded. The data so obtained was standardized for different institutions and journals as there was wide variation in the manner in which the names of different institutions and journals were written. Names of funding agencies to which different institutions belonged were also added to the database.

Objectives of the study

- To find the distribution of output according to performing sectors;

- To identify most prolific institutions;
- To find the distribution of output among different disciplines; and
- To identify highly productive journals.

Analysis

Of all the articles indexed by ISA during January 2006 to December 2008, 18224 pertained to the year 2006. These articles originated from 3,439 institutions located in different parts of the country and were scattered in 445 Indian journals. Of these, 548 articles were individual papers with residential address and 129 did not have any address at all. Detailed analysis of the output is provided in the following paragraphs.

Distribution of output according to performing sectors

Bulk of funding to R&D in India comes from the central government. Scientific research is mainly performed at the universities and the institutes of higher learning, besides the government funded laboratories under the Department of Atomic Energy (DAE), Department of Space (DOS), Department of Science and Technology (DST), Defense Research and Development Organization (DRDO), Council of Scientific and Industrial Research (CSIR), Indian Council of Agriculture Research (ICAR), and Indian Council of Medical Research (ICMR).

Table 1 presents the data on the distribution of scientific output according to performing sectors. This indicates

that academic institutions (universities and colleges) are the major contributors (~35%) of the total output. This is followed by output from state agriculture universities (SAUs) and medical colleges. These three sectors together contributed about 71% of the total output. Thus, almost three-fourth of the research output came from these three sectors. Other sectors listed in Table 1 and contributing 1% or more of the output is from institutions under the aegis of ICAR, CSIR, State Governments, Ministry of Environment and Forests, DST and DAE. Contributions from engineering colleges including Indian Institutes of Technology (IITs) are also more than 1%. Contributions from DRDO, ICMR, and DOS are quite less.

The publication output for 2006 was compared with the publication output for 1984 for those sectors for which data was available. It is observed that the contribution of academic institutions, SAUs, ICAR, DST, and ICMR is almost the same in both the years, i.e., 1984 and 2006. However, proportion of output published by CSIR and DAE in the Indian journals in 2006 is less as compared to 1984. One of the possible reasons for this may be the changing publication behavior of the scientists working in institutes under these two agencies.

Distribution of output according to prolific institutions

The number of institutions that published papers in 1984 was 2339. However, the number of institutions increased considerably during 2006 and the total output in 2006 came

Table 1 — Distribution of output according to performing sectors

Agency	Number of papers	% of papers
Academic Institutions	6,372 (5,184)	35.0 (37.0)
State Agriculture Universities	3,338 (2,145)	18.3 (15.0)
Medical colleges	3,185 (NA)	17.5 (NA)
Indian Council of Agriculture Research (ICAR)	1,226 (1,029)	6.7 (7.0)
Engineering colleges including IITs	893 (NA)	4.9 (NA)
Council of Scientific and Industrial Research (CSIR)	510 (1,051)	2.8 (7.5)
State Government Institutions	312 (NA)	1.7 (NA)
Ministry of Environment and Forests	222 (NA)	1.2 (NA)
Department of Science and Technology (DST)	211(121)	1.2 (0.9)
Department of Atomic Energy (DAE)	185 (461)	1.0 (3.3)
Private sector industrial R&D units	674 (NA)	3.7 (NA)
Defense Research and Development Organization (DRDO)	158 (86)	0.9 (0.61)
Indian Council of Medical Research (ICMR)	121(87)	0.7 (0.62)
Institutions under different economic ministries	306 (465)	1.7 (3.32)
Department of Space (DOS)	50 (150)	0.3 (1.1)
Individual and others	773 (NA)	4.2 (NA)
Total	18,224 (14,023)	100

Data in parentheses indicates output in 1984

from 3,439 institutions located in different parts of the country. Thus, 1100 more institutions contributed to Indian science in 2006 as compared to 1984. Of these, most prolific 50 institutions contributed 4,508 (~ 25%) of the total output and the remaining 3,389 institutions

contributed 13,716 (~75%) publications including individuals and anonymous authors. The name of 50 most prolific institutions along with their output is given in Table 2. A glance at the institutions listed in Table 2 indicates that 21 of these institutions belonged to state agriculture

Table 2 — Distribution of output according to institutions

Sl. No.	Institutions	Place	Papers
1	Punjab Agriculture University	Ludhiana	297
2	CCS Haryana Agricultural University	Hissar	261
3	Indian Agricultural Research Institute	New Delhi	214
4	Annamalai University	Annamalai	211
5	Tamilnadu Agriculture University	Chennai	204
6	All India Institute of Medical Sciences	New Delhi	174
7	Bidhan Chandra Krishi Vishwavidyalaya	Mohanpur	138
8	Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishwavidyalaya	Palampur	112
9	Indian Veterinary Research Institute	Izatnagar	106
10	G B Pant University of Agriculture and Technology	Pantnagar	103
11	Aligarh Muslim University	Aligarh	101
12	University of Agriculture Sciences	Dharwad	101
13	Andhra University	Visakhapatnam	96
14	University of Agriculture Sciences	Bangalore	95
15	University of Rajasthan	Jaipur	94
16	Post Graduate Institute of Medical Education and Research	Chandigarh	89
17	Indian Institute of Science	Bangalore	86
18	Jadavpur University	Jadavpur	81
19	Mahatma Phule Krishi Vidyapeeth	Ahmednagar	79
20	National Dairy Research Institute	Karnal	77
21	Bhabha Atomic Research Centre	Mumbai	75
22	Indira Gandhi Agricultural University	Raipur	75
23	Dr.Y S Parmar University of Horticulture and Forestry	Solan	71
24	Jawaharlal Nehru Krishi Vishwavidyalaya	Jabalpur	71
25	Indian Institute of Technology	Delhi	70
26	Banaras Hindu University	Varanasi	69
27	Rajendra Agricultural University	Pusa	69
28	University of Mysore	Mysore	67
29	Indian Institute of Technology	Kharagpur	66
30	Chandra Shekhar Azad University of Agriculture and Technology	Kanpur	63
31	Indian Institute of Technology	Roorkee	61
32	ICAR Research Complex for North Eastern Hill Region	Shillong	60
33	Kakatiya University	Warangal	59
34	Sher-e Kashmir University of Agriculture Science & Technology	Jammu	59
35	Botanical Survey of India	Kolkatta	58
36	Osmania University	Hyderabad	58
37	Christian Medical College and Hospital	Vellore	57
38	College of Agriculture	Hyderabad	56
39	Narendra Dev University of Agriculture and Technology	Kumarganj	56
40	College of Agriculture	Pantnagar	55
41	Acharya N G Ranga Agricultural University	Hyderabad	54
42	Jai Narain Vyas University	Jodhpur	54
43	Mahatma Gandhi Institute of Medical Sciences	Sevagram	54
44	Nagpur University	Nagpur	54
45	Sher-e-Kashmir Institute of Medical Sciences	Srinagar	53
46	Delhi University	Delhi	51
47	Indian Institute of Technology	Mumbai	50
48	Indian Institute of Technology	Chennai	48
49	Madras Veterinary College	Chennai	48
50	Rajasthan College of Agriculture	Udaipur	48
	Total		4,508
	Others		13,716
	Grand Total		18,224

Table 3 — Distribution of output according to disciplines

1	Agriculture, Forestry, Animal husbandry, and Fisheries	4,821(26.4)
2	Medical sciences and Veterinary medicine	4,765(26.1)
3	Chemistry	1,365(7.5)
4	Botany	1,167(6.4)
5	Engineering	1,084(5.9)
6	Biology	806(4.4)
7	Zoology	792(4.3)
8	Physics including Astronomy, Astrophysics, Space research & Geodesy	714(3.9)
9	Mathematics	587(3.2)
10	Environmental science, Nature and Wild life protection	620(3.4)
11	Geology, Meteorology and Hydrology	573(3.1)
12	Biotechnology	329(1.8)
13	Chemical technology and Food technology	296(1.6)
14	Leather, metal, paper & textile industries	165(0.9)
15	Computer science and technology	85(0.5)
16	Paleontology and Fossils	31(0.2)
17	Home science	14(0.1)
	Total	18214

(Figure in parenthesis indicate percentage)

universities, 13 to academic institutions, five each to medical and engineering colleges, four to Indian Council of Agriculture Research, one each to Department of Atomic Energy and Botanical Survey of India. Among the prolific institutions state agriculture universities contributed ~ 47% of the output followed by academic institutions (~ 24%). Like 1984, Punjab Agriculture University (PAU) ranks at the top in 2006 also. However, the proportional output of PAU has decreased in 2006 as compared to the proportional output in 1984.

Distribution of output according to disciplines

Scientific output from India in 2006 spread over 445 Indian journals covering a wide spectrum of subjects is presented in Table 3. Data presented in Table 3 indicates that medical science/veterinary medicine and agricultural

sciences including forestry, animal husbandry and fisheries each contributed about one-fourth of the total output. Thus, these two disciplines together constitute about half of the total Indian output. Remaining half of the output is scattered among other 15 disciplines, among which chemistry, botany and engineering contributed more than 5% of the output.

Communication pattern

Analysis of the data indicates that 18224 papers appeared in 445 journals published from different parts of the country. Table 4 provides the list of 41 journal titles which published 100 or more papers. These 41 titles published 6266 (34%) papers of the total output. However, two-third of the total output is concentrated in 119 titles. *Science Citation Index Expanded (SCI-E)* indexed 58 titles published 4642 (25%) papers of the total output.

Table 4 — Distribution of Indian S&T output in Indian journals

Journal	Place of publication	No. of papers
1. <i>Current Science</i>	Bangalore	425
2. <i>Asian Journal of Chemistry</i>	Ghaziabad	338
3. <i>Indian Veterinary Journal</i>	Izatnagar	335
4. <i>Environment and Ecology</i>	Kolkatta	327
5. <i>Asian Journal of Microbiology, Biotechnology and Environmental Science</i>	Aligarh	219
6. <i>Indian Medical Journal</i>	Kolkatta	218
7. <i>Plant Archives</i>	Muzaffarnagar	194
8. <i>Indian Journal of Experimental Biology</i>	New Delhi	177
9. <i>Antiseptic</i>	Madurai	170
10. <i>Indian Journal of Animal Sciences</i>	New Delhi	170
11. <i>Annals of Plant Protection Sciences</i>	New Delhi	169
12. <i>Journal of Economic and Taxonomic Botany</i>	Jodhpur	167
13. <i>Indian Journal of Chemistry - Sect B</i>	New Delhi	164
14. <i>Indian Journal of Pharmaceutical Sciences</i>	Mumbai	137
15. <i>Crop Research</i>	Hissar	134
16. <i>Indian Journal of Medical Research</i>	New Delhi	124
17. <i>Indian Forester</i>	Dehradun	124
18. <i>Indian Journal of Heterocyclic Chemistry</i>	Lucknow	123
19. <i>Acta Ciencia Indica - Mathematics</i>	Meerut	120
20. <i>Indian Journal of Physics</i>	Kolkatta	119
21. <i>Journal of Scientific and Industrial Research</i>	New Delhi	117
22. <i>Indian Journal of Agricultural Sciences</i>	New Delhi	117
23. <i>Obstetrics & Gynecology Today</i>	New Delhi	116
24. <i>International Journal of Agricultural Sciences</i>	NA	115
25. <i>Nature Environment and Pollution Technology</i>	Jaipur	115
26. <i>Journal of the Geological Society of India</i>	Kolkatta	115
27. <i>Journal of Aquatic Biology</i>	Hyderabad	113
28. <i>Pediatrics-Indian Edition</i>	NA	112
29. <i>Indian Journal of Chemistry - Sect A</i>	New Delhi	112
30. <i>Journal of Oilseeds Research</i>	Hyderabad	111
31. <i>Ultra Scientist of Physical Sciences</i>	Bhopal	111
32. <i>International Journal of Chemical Sciences</i>	NA	111
33. <i>Medical Journal Armed Forces India</i>	Pune	110
34. <i>Indian Journal of Entomology</i>	New Delhi	107
35. <i>Indian Journal of Pure and Applied Physics</i>	New Delhi	107
36. <i>Indian Journal of Biotechnology</i>	New Delhi	106
37. <i>Journal of Phytological Research</i>	Bharatpur	105
38. <i>Journal of the Indian Chemical Society</i>	Kolkatta	105
39. <i>Indian Journal of Otolaryngology and Head and Neck Surgery</i>	Kolkatta	103
40. <i>Ecology Environment and Conservation</i>	Karad	103
41. <i>Journal of Indian Medical Association</i>	Kolkatta	101
Total		6,266
Other 404 journals		11,958
Grand Total 445 Journals		18,224

Conclusion

Indian Science Abstracts is a useful tool to study the scientific research productivity but it has its limitations which include the lack of coverage of Indian scientific papers published in foreign journals and also that it is more of an abstracting source. To arrive at a complete picture of the Indian scientific output one should use other multidisciplinary databases like Science Citation Index – Expanded (SCI – E) and SCOPUS in conjunction with ISA. The creation of Indian Science Citation Index would also be very useful in this context.

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